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YIELD TABLES FOR MANAGED STANDS OF Lodgepole Pine In Colorado and Wyoming

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Clifford A. Myers

Rocky Mountain Forest and Range Experiment Station
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Estimates of the growth and yield of managed stands can be obtained before managed stands are created. These estimates, compiled as yield tables, serve as guides for timber management decisions. Yields can be investigated to determine if management for timber production is a desirable goal for specific areas. Sets of yield tables can be prepared with various stocking levels, rotation lengths, and other variables subject to manipulation. How various management alternatives will affect yields can be estimated by comparing values in the tables.

An advance look at possible future returns is especially important for lodgepole pine (Pinus contorta Dougl.). This species reproduces readily and is a classic example of stagnation in growth. So much has been published on the growth of dense stands that the potential of lodgepole pine is often ignored. Amount of precipitation and length of growing season do create definite upper limits to yields in the lodgepole pine type. These limits, however, appear to be subject to increase through standard timber management techniques. Yield tables for managed stands indicate the increase possible, and the combination of management controls that can produce the desired result.

This publication presents: (1) working tools and other guides useful in the compilation of yield tables for managed, even-aged stands of lodgepole pine, and (2) examples of managed-stand yield tables. Instructions are limited to use of the working tools. Detailed explanations of how to obtain the working tools are available elsewhere.[2]

Management procedures to be examined with the yield tables may be varied within limits set by the ranges of variables used to develop the working tools. Stand age at initial thinning, stocking goals, and other management controls can be varied to determine their effect on timber production. The yield table that best describes the objectives of management becomes the standard for the forest. Similarly, each yield table reproduced here is based on one of several possible combinations of management goals. Managers of lodgepole pine who prefer other alternatives can use the working tools to compile yield tables that will describe their objectives.

Management Decisions

Several decisions must be made before yield tables can be compiled with aid of the working tools. As examples of the problems to be solved, the following decisions were made for the yield tables presented here:

1. Stands will be regenerated by clearcutting, with most seeds coming from the serotinous cones of trees felled on the cutting area.

[2] *Myers, Clifford A. Yield tables for managed stands with special reference to the Black Hills. U.S. Forest Serv. Res. Paper RM-21, 20 p., illus. Rocky Mountain Forest and Range Exp. Sta., Ft. Collins, Colo. 1966.*

2. Cultural operations such as slash disposal will be used to control seedling density so there will be about 2,000 well-distributed seedlings per acre when they are 10 years old.
3. Initial thinning can be delayed until the stands are 30 years old if density does not greatly exceed 2,000 trees per acre at age 10.
4. Desirable stocking levels, as defined in table 1, will usually range from 80 to 100. Various stocking levels are given in the columns of table 1. Basal area per acre increases with average diameter of the reserve stand (left column of table) until a diameter of 10.0 inches is reached. After this, stands are rethinned to the same basal area each time. For example, stands man-

Table 1.--Growing stock levels for lodgepole pine in Colorado and Wyoming. Basal areas after intermediate cutting in relation to average stand diameter.

Ave. stand d.b.h. after cutting	Growing stock level							
	50	60	70	80	90	100	110	120
Inches	Square feet per acre							
2.0	7.7	9.2	10.8	12.3	13.8	15.4	16.9	18.4
2.2	9.0	10.8	12.6	14.4	16.2	18.0	19.8	21.6
2.4	10.4	12.4	14.5	16.6	18.7	20.8	22.8	24.9
2.6	11.8	14.2	16.5	18.9	21.3	23.6	26.0	28.4
2.8	13.3	16.0	18.6	21.3	24.0	26.6	29.3	32.0
3.0	14.8	17.7	20.6	23.6	26.6	29.5	32.4	35.4
3.2	16.2	19.5	22.8	26.0	29.2	32.5	35.8	39.0
3.4	17.8	21.3	24.8	28.4	32.0	35.5	39.0	42.6
3.6	19.2	23.0	26.9	30.7	34.5	38.4	42.2	46.0
3.8	20.6	24.7	28.8	32.9	37.0	41.1	45.2	49.4
4.0	22.0	26.4	30.8	35.2	39.6	44.0	48.4	52.8
4.2	23.5	28.2	32.9	37.6	42.3	47.0	51.7	56.4
4.4	24.9	29.8	34.8	39.8	44.8	49.8	54.7	59.7
4.6	26.4	31.6	36.9	42.2	47.5	52.8	58.0	63.3
4.8	27.9	33.4	39.0	44.6	50.2	55.8	61.3	66.9
5.0	29.2	35.0	40.9	46.7	52.5	58.4	64.2	70.0
5.2	30.5	36.6	42.7	48.8	54.9	61.0	67.1	73.2
5.4	31.8	38.2	44.5	50.9	57.3	63.6	70.0	76.4
5.6	33.0	39.6	46.2	52.8	59.4	66.0	72.6	79.2
5.8	34.2	41.0	47.9	54.7	61.5	68.4	75.2	82.0
6.0	35.4	42.4	49.5	56.6	63.7	70.8	77.8	84.9
6.2	36.6	43.9	51.2	58.5	65.8	73.1	80.4	87.8
6.4	37.7	45.2	52.8	60.3	67.8	75.4	82.9	90.4
6.6	38.8	46.5	54.2	62.0	69.8	77.5	85.2	93.0
6.8	39.9	47.8	55.8	63.8	71.8	79.8	87.7	95.7
7.0	40.9	49.1	57.3	65.5	73.7	81.9	90.1	98.2
7.2	41.9	50.2	58.6	67.0	75.4	83.8	92.1	100.5
7.4	42.8	51.3	59.8	68.4	77.0	85.5	94.0	102.6
7.6	43.6	52.4	61.1	69.8	78.5	87.2	96.0	104.7
7.8	44.5	53.4	62.3	71.2	80.1	89.0	97.9	106.8
8.0	45.3	54.4	63.4	72.5	81.6	90.6	99.7	108.8
8.2	46.1	55.4	64.6	73.8	83.0	92.2	101.5	110.7
8.4	46.8	56.2	65.5	74.9	84.3	93.6	103.0	112.4
8.6	47.4	56.8	66.3	75.8	85.3	94.8	104.2	113.7
8.8	47.9	57.5	67.1	76.7	86.3	95.9	105.5	115.0
9.0	48.4	58.1	67.8	77.5	87.2	96.9	106.6	116.2
9.2	48.9	58.6	68.4	78.2	88.0	97.8	107.5	117.3
9.4	49.2	59.1	69.0	78.8	88.6	98.5	108.4	118.2
9.6	49.5	59.4	69.3	79.2	89.1	99.0	108.9	118.8
9.8	49.8	59.8	69.7	79.7	89.7	99.6	109.6	119.6
10.0+	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0

aged at stocking level 80 would be thinned to 35.2 square feet if average diameter is 4.0 inches. Each rethinning will leave 80 square feet of basal area per acre after diameter averages 10.0 inches.

Relationships shown in table 1 were developed originally for ponderosa pine.[2] They were judged to be suitable for lodgepole pine because similar intensities of thinning have been recommended for the two species.[3] [4]

Stands that conform to the first three management decisions will grow about as indicated by the following averages:

1. Stands with about 2,000 trees per acre at age 10 will contain about 1,700 trees at age 20, regardless of site quality. Total loss for the 10 years will be about 15 percent.
2. Numbers of trees per acre will be reduced by the following percentages as stand age increases from 20 to 30 years:

Site index	Reduction (Percent)
40, 50	3
60	6
70, 80	9

Similar reductions will occur over a range of 1,200 to 1,700 trees per acre at age 20.

3. Average stand diameter before thinning at age 30 will be as follows:

Site index	Diameter (Inches)
30	2.6
40	2.9
50	3.2
60	3.4
70	3.6
80	3.8

As mentioned previously, management decisions for particular areas may differ from those given here. Numbers of trees and average diameters that relate to other objectives can be determined on temporary plots, if necessary. The working tools presented below will remain useful so long as even-aged stands and thinning from below are retained in management prescriptions.

Working Tools

Six working tools are used to compile yield tables for managed, even-aged stands of lodgepole pine. Three tools provide predictions of future changes in a stand due to growth or thinning. One serves as a check to insure that realistic projections are made. Two tools permit conversion of stand density and height to stand volumes in various units.

Periodic Increase In Stand Diameter

Future average stand diameter can be estimated from the following relationship:

$$D_f = 2.1450 + 1.0222\, D_p - 1,2417 \log B_p + 0.0151\, S \qquad \text{(Equation 1)}$$

where:

D_f = average stand diameter in 10 years, in inches,
D_p = present stand diameter, in inches,
B_p = present basal area per acre, in square feet,
S = site index for lodgepole pine.[5]

Absence of thinning, fire, or other disturbance during the 10-year prediction period is assumed.

This relationship is applicable to even-aged stands of lodgepole pine with stocking levels of 50 to 170 at the beginning of the prediction period. Diameters sampled ranged from 2 to 12 inches; site indexes ranged from 30 to 76.

[3] *Alexander, Robert R. Thinning lodgepole pine in the Central Rocky Mountains. J. Forest. 58: 99-104, illus. 1960.*

[4] *Myers, Clifford A. Thinning improves development of young stands of ponderosa pine in the Black Hills. J. Forest. 56: 656-659, illus. 1958.*

[5] *Alexander, Robert R. Site indexes for lodgepole pine, with correction for stand density: Instructions for field use. U. S. Forest Serv. Res. Note RM-24, 7 p., illus. Rocky Mountain Forest and Range Exp. Sta., Ft. Collins, Colo. 1966.*

Limited extrapolation to larger diameters is possible and cannot be avoided at present. Well-stocked stands with average diameter larger than 12 inches that were also younger than about 200 years could not be found. Comparison with a similar prediction equation for ponderosa pine indicated that increase in the range of D_p sampled would not change the form of the equation above. Material change in the values of the regression constants appeared unlikely. Extrapolations for the yield tables (tables 5 to 14) were therefore made well beyond what might otherwise be done.

Diameter Increase From Thinning

Thinning from below will increase average stand diameter, regardless of changes caused by tree growth. Initial thinning to a desired stocking level will produce a relatively large increase. Rethinning to the same level to which the stand was thinned previously will result in a smaller change. Both increases are large enough to require consideration in growth predictions.

Rethinning an even-aged stand to the same growing stock level to which it was thinned 10 years previously will increase average diameter 0.3 inch. Rethinning after 30 years will increase diameter 0.5 inch. These changes occurred in stands with growing stock levels between 60 and 150.

Increase in average diameter caused by initial thinning of young stands with 1,200 to 4,400 trees per acre can be determined from table 2. Instructions for construction of such tables are available elsewhere.[6] To predict diameter changes, follow this procedure:

1. Determine the growing stock level to which the stand is to be thinned.
2. On a sheet of cross-section paper, plot basal areas from the appropriate column of table 1 over the corresponding diameters. Connect the points with a smooth line; this is the stocking line. Consider only the range of diameters within which diameter after thinning is expected to fall, such as from 2.5 to 4.5 inches.
3. From table 2 obtain the diameter after thinning that corresponds to initial diameter, and the estimated percentage of trees to be retained. For example, average stand diameter increases from 2.9 to 4.0 inches if 25 percent of the trees remain uncut.
4. Compute the basal area of the trees retained when average diameter is the after-thinning value read in step 3. For example, 25 percent of 1,650 trees, or 412.5 trees, have a basal area of 36.0 square feet when average diameter is 4.0 inches.
5. Plot computed basal area over diameter after thinning on the graph started in step 2.
6. Repeat steps 3 to 5 with a slightly different percentage of trees retained than used in step 3. Place a second point on the graph on the opposite side of the stocking line from the plotted point of step 5.
7. Draw a straight line through the points plotted in steps 5 and 6.
8. Read diameter after thinning on the horizontal axis of the graph, directly below intersection of the stocking line (step 2) and the trial line (step 7).

The plotted points of steps 5 and 6 should be as near as possible to the stocking line. A line connecting several plotted points on a single graph will only occasionally be straight. Interpolations in table 2 are unnecessary, however.

Periodic Increase In Basal Area

Future basal area per acre can be estimated from the following relationship:

$$B_f = 5.6456 + 0.9261\, B_p + 0.2146\, S + 0.0004\, NS \qquad \text{(Equation 2)}$$

where:
B_f = basal area in 10 years, in square feet,
B_p = present basal area, in square feet,
S = site index for lodgepole pine,[7]
N = present number of trees per acre.

This relationship is used to be sure that projections of diameter growth are reasonable, as described in Derivation of Yield Tables.

[6] *See footnote 2, p. 1.*

[7] *See footnote 5, p. 3.*

Table 2.--Increase in average stand diameter caused by initial thinning from below. Even-aged stands of lodgepole pine in Colorado and Wyoming.

Diameter before thinning (inches)	Percent of trees retained: 5	10	15	20	25	30	35	40	45	50
	Diameter after thinning, inches									
2.5	4.1	3.9	3.7	3.6	3.5	3.4	3.3	3.2	3.1	3.0
2.6	4.3	4.1	3.9	3.7	3.6	3.5	3.4	3.3	3.2	3.2
2.7	4.4	4.2	4.0	3.8	3.7	3.6	3.5	3.4	3.3	3.3
2.8	4.6	4.3	4.2	4.0	3.8	3.7	3.6	3.5	3.4	3.4
2.9	4.7	4.5	4.3	4.1	4.0	3.8	3.7	3.6	3.6	3.5
3.0	4.8	4.6	4.4	4.2	4.1	3.9	3.8	3.7	3.7	3.6
3.1	4.9	4.7	4.5	4.3	4.2	4.1	4.0	3.9	3.8	3.7
3.2	5.0	4.8	4.6	4.4	4.3	4.2	4.1	4.0	3.9	3.8
3.3	5.1	4.9	4.7	4.6	4.4	4.3	4.2	4.1	4.0	3.9
3.4	5.2	5.0	4.8	4.7	4.5	4.4	4.3	4.2	4.1	4.0
3.5	5.4	5.1	4.9	4.8	4.6	4.5	4.4	4.3	4.2	4.1
3.6	5.5	5.2	5.0	4.9	4.8	4.6	4.5	4.4	4.3	4.2
3.7	5.6	5.3	5.2	5.0	4.9	4.8	4.6	4.5	4.4	4.3
3.8	5.7	5.4	5.3	5.1	5.0	4.9	4.7	4.6	4.5	4.4
3.9	5.8	5.6	5.4	5.2	5.1	5.0	4.8	4.7	4.6	4.5
4.0	6.0	5.7	5.5	5.4	5.2	5.1	4.9	4.8	4.7	4.6
4.1	6.1	5.8	5.6	5.5	5.3	5.2	5.0	4.9	4.8	4.7
4.2	6.2	6.0	5.8	5.6	5.4	5.3	5.2	5.1	5.0	4.9
4.3	6.3	6.1	5.9	5.7	5.6	5.4	5.3	5.2	5.1	5.0
4.4	6.4	6.2	6.0	5.9	5.7	5.5	5.4	5.3	5.2	5.1
4.5	6.6	6.4	6.2	6.0	5.8	5.6	5.5	5.4	5.3	5.2

Height Of Dominants And Codominants

Future average heights of dominant and codominant lodgepole pines can be estimated if site index and stand age are known (table 3). In addition, the stands must never have been so dense that height growth was reduced. Heights at age 100 and site index class midpoints are not equal in table 3 because site indexes were obtained from the heights of dominant trees only.[7]

Stand Volume Equation

Stand volumes in cubic feet per acre can be determined from stand basal area and average height. The relationship is as follows:

$V = 16.96 + 0.50\ BH$ (Equation 3)

$r^2 = 0.998\ \ S_{y.x} = 44.85$ (2.3% of mean)

where:

V = gross volume per acre in cubic feet, from ground line to tip, of all trees larger than 4.5 feet tall, [8]

B = basal area per acre, in square feet,

H = average total height of dominant and codominant trees, in feet.

The equation is applicable to even-aged stands of lodgepole pine.

[8] *Myers, Clifford A. Volume tables and point-sampling factors for lodgepole pine in Colorado and Wyoming. U.S. Forest Serv. Res. Paper RM-6, 16 p. Rocky Mountain Forest and Range Exp. Sta., Ft. Collins, Colo. 1964.*

Table 3.--Average height of dominant and codominant trees at various ages, lodgepole pine in Colorado and Wyoming.

Main stand age (Years)	Site index class					
	30	40	50	60	70	80
10	5	6	6	7	7	8
20	10	12	14	17	19	22
30	14	17	21	25	28	32
40	16	20	25	31	35	40
50	18	23	29	36	41	47
60	20	26	33	41	47	54
70	22	29	37	45	52	60
80	24	32	41	49	57	66
90	26	34	44	53	62	71
100	28	37	47	57	66	76
110	30	39	49	60	69	80
120	32	41	52	63	72	83
130	33	43	54	65	75	86
140	35	45	56	67	77	88
150	37	47	58	69	79	90

Volume Conversion Factors

Volumes in total cubic feet of stem wood provide reliable measures of volume that do not change as utilization standards vary. Total volumes should, however, be convertible to other units so forest production can be estimated in terms familiar to the forest industry. Volumes computed from the stand volume equation can be converted to cubic feet to a 4-inch top (table 4a) or to board feet (table 4b). Multiply total cubic feet by the factor appropriate for the desired unit and the average stand diameter. Measurement standards such as stump height and merchantable top diameter are the same as for the tree volume equations from which the stand volumes used to obtain the factors were computed. [9]

Derivation of Yield Tables

Two sets of yield tables were prepared to illustrate the procedure for derivation of managed-stand yield tables. Five tables (tables 5 to 9) are based on a cutting interval of 10 years. Tables 10 to 14 show the results obtainable from cutting at 30-year intervals. Site indexes of 40 to 80 (base age 100 years) and stocking levels of 80 and 100 were selected for the examples because they are applicable to many stands in Colorado and Wyoming.

Procedure for the derivation of yield tables with 10-year cutting intervals is as follows:

1. Record number of trees and average stand diameter just prior to thinning for each site index class of interest. Compute basal area per acre from these two values. For example, the first set of entries for stand age 30 in table 5 describes stands ready for initial thinning.
2. Determine average diameter immediately after initial thinning from table 2 and the procedure described in the section "Diameter Increase from Thinning."
3. Obtain basal area immediately after initial thinning from the appropriate column of table 1 and the diameter determined in step 2. Divide this basal area by the basal area of the tree of average diameter to compute the number of trees present immediately after initial thinning.
4. Estimate average stand diameter in 10 years with equation 1. For example, 4.0 inches will increase to 4.9 inches in 10

[9] *See footnote 8, p. 5.*

Table 4a.--Factors for conversion of stand volumes in total cubic feet to merchantable cubic feet per acre. Lodgepole pine in Colorado and Wyoming[1/]

Average stand diameter (inches)	Ratio of merchantable to total volume	Average stand diameter (inches)	Ratio of merchantable to total volume
5.8	.494	10.4	.931
6.0	.547	10.6	.934
6.2	.599	10.8	.936
6.4	.651	11.0	.937
6.6	.690	11.5	.941
6.8	.724	12.0	.945
7.0	.753	12.5	.948
7.2	.778	13.0	.950
7.4	.800	13.5	.952
7.6	.819	14.0	.953
7.8	.835	14.5	.954
8.0	.849	15.0	.955
8.2	.861	15.5	.956
8.4	.871	16.0	.957
8.6	.880	16.5	.958
8.8	.888	17.0	.959
9.0	.896	17.5	.960
9.2	.902	18.0	.961
9.4	.908	18.5	.962
9.6	.914	19.0	.963
9.8	.919	19.5	.964
10.0	.924	20.0	.965
10.2	.928	20.5	.966

1/ To 4.0-inch top in trees 6.0 inches d.b.h. and larger.

Table 4b.--Factors for conversion of stand volumes in total cubic feet to board feet per acre[1/]

Average stand diameter (inches)	Ratio of board feet Scribner to total volume	Ratio of board feet Inter. ¼" to total volume
9.6	2.05	2.42
9.8	2.23	2.62
10.0	2.40	2.81
10.2	2.57	3.00
10.4	2.72	3.18
10.6	2.86	3.35
10.8	3.00	3.50
11.0	3.13	3.65
11.2	3.24	3.79
11.4	3.36	3.92
11.6	3.45	4.04
11.8	3.54	4.16
12.0	3.63	4.26
12.2	3.71	4.36
12.4	3.78	4.46
12.6	3.85	4.55
12.8	3.92	4.64
13.0	3.98	4.72
13.5	4.11	4.88
14.0	4.22	5.01
14.5	4.32	5.12
15.0	4.41	5.20
15.5	4.48	5.26
16.0	4.55	5.32
16.5	4.61	5.37
17.0	4.67	5.41
17.5	4.72	5.45
18.0	4.77	5.48
18.5	4.82	5.51
19.0	4.86	5.54
19.5	4.90	5.57
20.0	4.94	5.60
20.5	4.97	5.62

1/ In trees 10.0 inches d.b.h. and larger to an 8-inch top.

years under the conditions given in table 5.

5. Reduce number of trees present immediately after initial thinning by the amount of periodic loss. Percentage loss is determined from stand diameter, as follows:

Average stand diameter (Inches)	Trees lost in 10 years (Percent)
3.0 - 3.9	1.4
4.0 - 4.9	0.9
5.0 - 5.9	0.7
6.0 - 6.9	0.6
7.0 - 7.9	0.4
8.0 - 8.9	0.2
9.0+	0.0

For example, 403 trees at age 30 will be reduced to 399 trees at age 40 if average diameter is 4.0 inches at age 30.

6. Multiply number of trees (step 5) by the basal area of the tree of computed average diameter (step 4) to obtain basal area per acre 10 years after initial thinning. Retain one or two decimal places until the yield table is completed and checked.
7. Increase average diameter 0.3 inch to convert diameter before the second thinning to diameter after thinning. See the section "Diameter Increase from Thinning."
8. Obtain from table 1 the basal area after second thinning. Enter the table with the diameter after thinning of step 7 and the growing stock level already decided upon.
9. Divide basal area after second thinning (step 8) by the basal area of the tree of average diameter after second thinning (step 7) to obtain number of trees per acre.
10. Repeat steps 4 to 9 until the desired stand age is reached.
11. Compute the periodic changes in basal area with equation 2. Do not enter the results in the yield table, but compare them with yield table values. Basal areas from the equation and basal areas entered in the yield table will agree within ± 3.5 square feet if the projections of steps 4 to 10 are reasonable.
12. Record heights in the average height column of the yield table. Copy average dominant and codominant heights from the appropriate column of table 3.
13. Compute total cubic feet per acre before and after thinning for each stand age in the yield table. Use the stand volume equation, (equation 3). Do not round off volumes as shown in table 5 until the yield table is completed and checked.
14. Convert total cubic feet to other units per acre with the factors of tables 4a and 4b. Footnotes to these tables indicate the portion of the stand measured. The first entry of merchantable or board-foot volume in a yield table may occasionally show volume after thinning to be slightly larger than volume before thinning. In such cases, use the computed volume after thinning for both entries.
15. Round off basal area and volume values to remove unnecessary units and decimals that were retained during computations and checking.
16. Subtract values after thinning from values before thinning to obtain the periodic cuts. Volumes and basal areas of trees that died during the rotation could be computed and added to rotation totals, if desired. The amounts should be so small in managed stands that this computation would be unnecessary.

Yield tables with cutting cycles other than 10 years (tables 10 to 14) are derived with almost the same procedure as that outlined above. Differences are as follows:

1. Stand diameter, basal area, and number of trees are computed for each 10-year period. Computed values are then used in projections for the following 10 years with no changes due to thinning until the proper stand ages for cutting are reached.
2. Rethinning to the assigned stocking level will increase average stand diameter 0.4 inch with a 20-year cutting cycle and 0.5 inch with a 30-year cutting cycle.

After the yield tables have been compiled and checked, they are suitable for a variety of uses. Rotations may be determined from culmination of mean annual increment, with the effect of thinnings included in the computation. Rotations may be determined from the soil rent formula, with the yield tables providing data from which to compute money yields and costs of precommercial thinning. Site index classes may be converted to a productivity

classification based on a value such as maximum mean annual increment.

For all these purposes and many others, the yield table procedure given here provides: (1) information now instead of after many years' work on permanent plots, (2) a choice of alternatives for important management controls such as growing stock level, and (3) a means for quickly recomputing management guides if stocking goals or product objectives change.

Table 5.--Yields per acre of managed, even-aged stands of lodgepole pine in Colorado and Wyoming.

Site index 40, 10-year cutting cycle.

Stand age (years)	Trees	Basal area	Ave. d.b.h.	Average height	Volume			Periodic cut				
					Total	Merch.	Sawtimber	Trees	Basal area	Total vol.	Merch. vol.	Sawtimber vol.
	No.	Sq.ft.	In.	Ft.	--Cu.ft.--		Bd.ft.	No.	Sq.ft.	--Cu.ft.--		Bd.ft.
10	2,000	4	0.6	6								
30	1,650	76	2.9	17	660							
30	403	35	4.0	17	320			1,247	41	340	0	0
40	399	52	4.9	20	540							
40	331	49	5.2	20	500			68	3	40	0	0
50	329	65	6.0	23	760	440						
50	274	59	6.3	23	700	440		55	6	60	0	0
60	272	73	7.0	26	960	720						
60	233	68	7.3	26	900	710		39	5	60	10	0
70	232	79	7.9	29	1,160	980						
70	201	74	8.2	29	1,090	940		31	5	70	40	0
80	201	85	8.8	32	1,380	1,220						
80	172	78	9.1	32	1,260	1,140		29	7	120	80	0
90	172	88	9.7	34	1,520	1,390	3,300					
90	147	80	10.0	34	1,380	1,270	3,300	25	8	140	120	0
100	147	90	10.6	37	1,680	1,570	4,800					
100	123	80	10.9	37	1,500	1,400	4,600	24	10	180	170	200
110	123	89	11.5	39	1,750	1,640	5,900					
110	105	80	11.8	39	1,580	1,490	5,600	18	9	170	150	300
120	105	88	12.4	41	1,820	1,730	6,900	105	88	1,820	1,730	6,900

Table 6.--Yields per acre of managed, even-aged stands of lodgepole pine in Colorado and Wyoming.

Site index 50, 10-year cutting cycle.

Stand age (years)	Trees	Basal area	Ave. d.b.h.	Average height	Volume			Periodic cut				
					Total	Merch.	Sawtimber	Trees	Basal area	Total vol.	Merch. vol.	Sawtimber vol.
	No.	Sq.ft.	In.	Ft.	--Cu.ft.--		Bd.ft.	No.	Sq.ft.	--Cu.ft.--		Bd.ft.
10	2,000	4	0.6	6								
30	1,650	92	3.2	21	990							
30	377	40	4.4	21	430			1,273	52	560	0	0
40	374	59	5.4	25	760							
40	303	54	5.7	25	690			71	5	70	0	0
50	301	72	6.6	29	1,050	730						
50	249	65	6.9	29	960	700		52	7	90	30	0
60	248	80	7.7	33	1,340	1,110						
60	208	72	8.0	33	1,210	1,030		40	8	130	80	0
70	208	88	8.8	37	1,640	1,460						
70	172	78	9.1	37	1,460	1,310		36	10	180	150	0
80	172	92	9.9	41	1,900	1,750	4,400					
80	141	80	10.2	41	1,660	1,540	4,300	31	12	240	210	100
90	141	93	11.0	44	2,060	1,930	6,500					
90	115	80	11.3	44	1,780	1,670	5,900	26	13	280	260	600
100	115	92	12.1	47	2,170	2,060	8,000					
100	95	80	12.4	47	1,900	1,800	7,200	20	12	270	260	800
110	95	90	13.2	49	2,230	2,120	9,000					
110	80	80	13.5	49	1,980	1,880	8,100	15	10	250	240	900
120	80	89	14.3	52	2,340	2,230	10,000	80	89	2,340	2,230	10,000

Table 7.--Yields per acre of managed, even-aged stands of lodgepole pine in Colorado and Wyoming.

Site index 60, 10-year cutting cycle.

Stand age (years)	Trees	Basal area	Ave. d.b.h.	Average height	Volume			Periodic cut				
					Total	Merch.	Sawtimber	Trees	Basal area	Total vol.	Merch. vol.	Sawtimber vol.
	No.	Sq.ft.	In.	Ft.	--Cu.ft.--		Bd.ft.	No.	Sq.ft.	--Cu.ft.--		Bd.ft.
10	2,000	4	0.6	7								
30	1,600	101	3.4	25	1,280							
30	366	42	4.6	25	540			1,234	59	740	0	0
40	363	64	5.7	31	1,010	490						
40	288	57	6.0	31	890	490		75	7	120	0	0
50	286	76	7.0	36	1,390	1,050						
50	233	68	7.3	36	1,240	970		53	8	150	80	0
60	232	85	8.2	41	1,760	1,520						
60	191	75	8.5	41	1,560	1,370		41	10	200	150	0
70	191	92	9.4	45	2,090	1,900	3,900					
70	155	79	9.7	45	1,810	1,650	3,900	36	13	280	250	0
80	155	95	10.6	49	2,340	2,190	6,700					
80	123	80	10.9	49	1,980	1,850	6,000	32	15	360	340	700
90	123	93	11.8	53	2,490	2,350	8,800					
90	100	80	12.1	53	2,140	2,020	7,800	23	13	350	330	1,000
100	100	94	13.1	57	2,680	2,550	10,800					
100	82	80	13.4	57	2,300	2,190	9,400	18	14	380	360	1,400
110	82	93	14.4	60	2,800	2,670	12,000					
110	68	80	14.7	60	2,420	2,310	10,500	14	13	380	360	1,500
120	68	91	15.7	63	2,900	2,770	13,100	68	91	2,900	2,770	13,100

Table 8.--Yields per acre of managed, even-aged stands of lodgepole pine in Colorado and Wyoming.

Site index 70, 10-year cutting cycle.

Stand age (years)	Trees	Basal area	Ave. d.b.h.	Average height	Volume			Periodic cut				
					Total	Merch.	Sawtimber	Trees	Basal area	Total vol.	Merch. vol.	Sawtimber vol.
	No.	Sq.ft.	In.	Ft.	--Cu.ft.--		Bd.ft.	No.	Sq.ft.	--Cu.ft.--		Bd.ft.
10	2,000	4	0.6	7								
30	1,550	110	3.6	28	1,550							
30	458	53	4.6	28	760			1,092	57	790	0	0
40	454	83	5.8	35	1,470	730						
40	355	72	6.1	35	1,280	730		99	11	190	0	0
50	353	97	7.1	41	2,010	1,540						
50	286	86	7.4	41	1,770	1,420		67	11	240	120	0
60	285	110	8.4	47	2,590	2,260						
60	231	95	8.7	47	2,260	2,000		54	15	330	260	0
70	231	116	9.6	52	3,040	2,770	6,200					
70	187	100	9.9	52	2,610	2,410	6,100	44	16	430	360	100
80	187	119	10.8	57	3,410	3,190	10,200					
80	149	100	11.1	57	2,870	2,690	9,100	38	19	540	500	1,100
90	149	119	12.1	62	3,710	3,510	13,600					
90	119	100	12.4	62	3,120	2,950	11,800	30	19	590	560	1,800
100	119	117	13.4	66	3,860	3,680	15,800					
100	98	100	13.7	66	3,320	3,160	13,800	21	17	540	520	2,000
110	98	116	14.7	69	4,000	3,820	17,400					
110	81	100	15.0	69	3,470	3,310	15,300	17	16	530	510	2,100
120	81	115	16.1	72	4,140	3,960	18,900	81	115	4,140	3,960	18,900

Table 9.--Yields per acre of managed, even-aged stands of lodgepole pine in Colorado and Wyoming.

Site index 80, 10-year cutting cycle.

Stand age (years)	Trees	Basal area	Ave. d.b.h.	Average height	Volume			Periodic cut				
					Total	Merch.	Sawtimber	Trees	Basal area	Total vol.	Merch. vol.	Sawtimber vol.
	No.	Sq.ft.	In.	Ft.	--Cu.ft.--		Bd.ft.	No.	Sq.ft.	--Cu.ft.--		Bd.ft.
10	2,000	4	0.6	8								
30	1,550	122	3.8	32	1,970							
30	436	57	4.9	32	930			1,114	65	1,040	0	0
40	432	91	6.2	40	1,830	1,100						
40	332	76	6.5	40	1,540	1,040		100	15	290	60	0
50	330	107	7.7	47	2,520	2,090						
50	260	91	8.0	47	2,150	1,820		70	16	370	270	0
60	259	117	9.1	54	3,180	2,850						
60	204	98	9.4	54	2,680	2,430		55	19	500	420	0
70	204	123	10.5	60	3,700	3,450	10,300					
70	157	100	10.8	60	3,020	2,820	9,100	47	23	680	630	1,200
80	157	121	11.9	66	4,020	3,790	14,400					
80	123	100	12.2	66	3,320	3,140	12,300	34	21	700	650	2,100
90	123	119	13.3	71	4,230	4,020	17,200					
90	99	100	13.6	71	3,570	3,400	14,700	24	19	660	620	2,500
100	99	118	14.8	76	4,510	4,310	19,700					
100	80	100	15.1	76	3,820	3,650	16,900	19	18	690	660	2,800
110	80	116	16.3	80	4,650	4,460	21,400					
110	67	100	16.6	80	4,020	3,850	18,600	13	16	630	610	2,800
120	67	116	17.8	83	4,820	4,630	22,900	67	116	4,820	4,630	22,900

Table 10.--Yields per acre of managed, even-aged stands of lodgepole pine in Colorado and Wyoming.

Site index 40, 30-year cutting cycle.

Stand age (years)	Trees	Basal area	Ave. d.b.h.	Average height	Volume			Periodic cut				
					Total	Merch.	Sawtimber	Trees	Basal area	Total vol.	Merch. vol.	Sawtimber vol.
	No.	Sq.ft.	In.	Ft.	--Cu.ft.--		Bd.ft.	No.	Sq.ft.	--Cu.ft.--		Bd.ft.
10	2,000	4	0.6	6								
30	1,650	76	2.9	17	660							
30	403	35	4.0	17	320			1,247	41	340	0	0
60	392	82	6.2	26	1,090	650						
60	257	63	6.7	26	830	590		135	19	260	60	0
90	253	100	8.5	34	1,710	1,500						
90	175	78	9.0	34	1,330	1,200		78	22	380	300	0
120	175	107	10.6	41	2,220	2,070	6,300	175	107	2,220	2,070	6,300
							Totals:	1,635	189	3,200	2,430	6,300

Table 11.--Yields per acre of managed, even-aged stands of lodgepole pine in Colorado and Wyoming.

Site index 50, 30-year cutting cycle.

Stand age (years)	Trees	Basal area	Ave. d.b.h.	Average height	Volume			Periodic cut				
					Total	Merch.	Sawtimber	Trees	Basal area	Total vol.	Merch. vol.	Sawtimber vol.
	No.	Sq.ft.	In.	Ft.	--Cu.ft.--		Bd.ft.	No.	Sq.ft.	--Cu.ft.--		Bd.ft.
10	2,000	4	0.6	6								
30	1,650	92	3.2	21	990							
30	377	40	4.4	21	430			1,273	52	560	0	0
60	369	96	6.9	33	1,600	1,180						
60	229	68	7.4	33	1,150	920		140	28	450	260	0
90	228	112	9.5	44	2,490	2,260	4,900					
90	147	80	10.0	44	1,780	1,640	4,300	81	32	710	620	600
120	147	117	12.1	52	3,070	2,900	11,300	147	117	3,070	2,900	11,300
							Totals:	1,641	229	4,790	3,780	11,900

Table 12.--Yields per acre of managed, even-aged stands of lodgepole pine in Colorado and Wyoming.

Site index 60, 30-year cutting cycle.

Stand age (years)	Trees	Basal area	Ave. d.b.h.	Average height	Volume			Periodic cut				
					Total	Merch.	Sawtimber	Trees	Basal area	Total vol.	Merch. vol.	Sawtimber vol.
	No.	Sq.ft.	In.	Ft.	--Cu.ft.--		Bd.ft.	No.	Sq.ft.	--Cu.ft.--		Bd.ft.
10	2,000	4	0.6	7								
30	1,600	101	3.4	25	1,280							
30	366	42	4.6	25	540			1,234	59	740	0	0
60	358	107	7.4	41	2,210	1,770						
60	211	72	7.9	41	1,490	1,260		147	35	720	510	0
90	210	124	10.4	53	3,300	3,070	9,000					
90	123	80	10.9	53	2,140	2,000	6,500	87	44	1,160	1,070	2,500
120	123	122	13.5	63	3,870	3,680	15,900	123	122	3,870	3,680	15,900
							Totals:	1,591	260	6,490	5,260	18,400

Table 13.--Yields per acre of managed, even-aged stands of lodgepole pine in Colorado and Wyoming.

Site index 70, 30-year cutting cycle.

Stand age (years)	Trees	Basal area	Ave. d.b.h.	Average height	Volume			Periodic cut				
					Total	Merch.	Sawtimber	Trees	Basal area	Total vol.	Merch. vol.	Sawtimber vol.
	No.	Sq.ft.	In.	Ft.	--Cu.ft.--		Bd.ft.	No.	Sq.ft.	--Cu.ft.--		Bd.ft.
10	2,000	4	0.6	7								
30	1,550	110	3.6	28	1,550							
30	458	53	4.6	28	760			1,092	57	790	0	0
60	448	137	7.5	47	3,250	2,630						
60	260	91	8.0	47	2,150	1,820		188	46	1,100	810	0
90	258	158	10.6	62	4,920	4,590	14,100					
90	149	100	11.1	62	3,120	2,920	9,900	109	58	1,800	1,670	4,200
120	149	155	13.8	72	5,590	5,330	23,400	149	155	5,590	5,330	23,400
							Totals:	1,538	316	9,280	7,810	27,600

Table 14.--Yields per acre of managed, even-aged stands of lodgepole pine in Colorado and Wyoming.

Site index 80, 30-year cutting cycle.

Stand age (years)	Trees	Basal area	Ave. d.b.h.	Average height	Volume			Periodic cut				
					Total	Merch.	Sawtimber	Trees	Basal area	Total vol.	Merch. vol.	Sawtimber vol.
	No.	Sq.ft.	In.	Ft.	--Cu.ft.--		Bd.ft.	No.	Sq.ft.	--Cu.ft.--		Bd.ft.
10	2,000	4	0.6	8								
30	1,550	122	3.8	32	1,970							
30	436	57	4.9	32	930			1,114	65	1,040	0	0
60	427	157	8.2	54	4,240	3,650						
60	231	95	8.7	54	2,590	2,290		196	62	1,650	1,360	0
90	231	172	11.7	71	6,140	5,790	21,500					
90	123	100	12.2	71	3,570	3,370	13,200	108	72	2,570	2,420	8,300
120	123	159	15.4	83	6,620	6,330	29,600	123	159	6,620	6,330	29,600
							Totals:	1,541	358	11,880	10,110	37,900

Myers, Clifford A.
1967. Yield tables for managed stands of lodgepole pine in Colorado and Wyoming. U. S. Forest Serv. Res. Paper RM-26, 20 pp. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado, 80521.

Presents working tools useful in the compilation of yield tables for managed, even-aged stands. Stand age at initial thinning, stocking goals, and other management controls may be varied as desired. The yield table that best describes the objectives of management becomes the standard for the forest.

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ABOUT THE COVER:

Hairy grama (Bouteloua hirsuta), a desirable forage grass characteristic of many southwestern ranges.